

ENERGY ENGINEERING, B.S.

Begin Campus: Any Penn State Campus

End Campus: University Park

Program Description

The undergraduate program in energy engineering is designed to reflect the growing impact and demand for energy in society and to equip students with the knowledge necessary to achieve the following career and professional goals: become valuable contributors in addressing society's energy needs and demands; successful leaders in advancing the technology and management of energy; innovators and entrepreneurs in the energy sector; and educators, practicing engineers, and national leaders on energy and associated environmental, health and safety, and policy and economics issues. The program integrates skill sets in the physical sciences (chemistry, engineering, mathematics, and physics) and social sciences (economics, policy, and management) to ensure successful career opportunities and growth within energy-related industries, government agencies, and academia.

The courses are structured to enable students to understand engineering fundamentals and apply the knowledge to solve problems in the production, processing, storage, distribution, and utilization of energy using multiple techniques as synthesis, analysis, design and case studies. Inquiry-based teaching methods and lab experiences are emphasized. The faculty research and scholarly activities are integrated into the curriculum. The program is designed to train students to be lifelong learners, problem solvers, and energy industry leaders. The educational opportunities are sufficiently flexible, broad, and diverse to enable students to tailor their educational experience to particular interests, background, and expected role in society. Flexibility in the curriculum allows other students in energy related programs such as agricultural and biological, chemical, civil, electrical, environmental, mechanical, mining, nuclear, and petroleum engineering, materials science and engineering, industrial health and safety, and energy business and finance to have dual or concurrent degrees, minors, or options (e.g., energy and fuels engineering option in chemical engineering).

What is Energy Engineering?

Energy engineers are equipped with required engineering knowledge and skills needed to solve problems in the production, processing, storage, distribution, and utilization of energy. Energy processes include natural resources, such as the extraction of oil and gas, as well as from renewable or sustainable sources of energy, including biofuels, hydro, wind, and solar power.

You Might Like This Program If...

- You aspire to be a lifelong learner, problem-solver, and leader in the energy industry.
- You excel at math, science, and engineering and seek a broad overview of energy fields.
- You're interested in a well-rounded education on all facets of the energy market, including renewable energy.

Entrance to Major

In addition to the minimum grade point average (GPA) requirements described in the University Policies, the Energy Engineering entrance-to-major requirement must also be completed with a minimum grade of C

in: CHEM 110, CHEM 111, CHEM 112, MATH 140, MATH 141, MATH 231, PHYS 211, and PHYS 212.

Degree Requirements

For the Bachelor of Science degree in Energy Engineering, a minimum of 131 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	116

30 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 3 credits of GH courses; 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 9 credits of GWS courses.

Requirements for the Major

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Code	Title	Credits
Prescribed Courses		
EE 211	Electrical Circuits and Power Distribution	3
EGEE 12	Energy Science and Engineering Lectures	1
FSC 431	The Chemistry of Fuels	3
FSC 432	Petroleum Processing	3
MATH 251	Ordinary and Partial Differential Equations	4
MATSE 201	Introduction to Materials Science	3
PHIL 103	Ethics	3
<i>Prescribed Courses: Require a grade of C or better</i>		
CHEM 110	Chemical Principles I	3
CHEM 111	Experimental Chemistry I	1
CHEM 112	Chemical Principles II	3
EGEE 302	Principles of Energy Engineering	3
EGEE 304	Heat and Mass Transfer	3
EGEE 411W	Energy Science and Engineering Lab	3
EGEE 430	Introduction to Combustion	3
EGEE 438	Wind and Hydropower Energy Conversion	3
EGEE 437	Design of Solar Energy Conversion Systems	3
EGEE 441	Electrochemical Engineering Fundamentals	3
EGEE 451	Energy Conversion Processes	3
EGEE 464W	Energy Design Project	3
EME 301	Thermodynamics in Energy and Mineral Engineering	3
EME 303	Fluid Mechanics in Energy and Mineral Engineering	3
EMSC 100S	Earth and Mineral Sciences First-Year Seminar ¹	3
ENGL 202C	Effective Writing: Technical Writing	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
MATH 231	Calculus of Several Variables	2
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4

Additional Courses

CHEM 202	Fundamentals of Organic Chemistry I	3
or CHEM 210	Organic Chemistry I	
EME 460	Geo-resource Evaluation and Investment Analysis	3
or IE 302	Engineering Economy	
Select 3 credits of the following:		3
EBF 200	Introduction to Energy and Earth Sciences Economics	
ECON 14	Principles of Economics	
ECON 102	Introductory Microeconomic Analysis and Policy	
<i>Additional Courses: Require a grade of C or better</i>		
CMPSC 200	Programming for Engineers with MATLAB	3
or CMPSC 201	Programming for Engineers with C++	
EGEE 494	Research Project	2
or EGEE 295/395/495	Internship	
ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	

Supporting Courses and Related Areas

Select 3 credits of EGEE electives from an approved list in consultation with an adviser	3
Select 6 credits of professional courses from an approved list in consultation with an adviser. Other substitutions outside the approved list must be approved by petition.	6
Select 6 credits of technical electives from a broad list of energy related courses across colleges at Penn State. A list of suggested courses from energy-related departments at Penn State is provided. (Students may apply 6 credits of ROTC to some of the elective choices.)	6

¹ The following substitutions are allowed for students attending campuses where the indicated course is not offered: CAS 100 can be substituted for EMSC 100S.

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (<https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/>) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 3 credits
- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

Exploration

- **GN**, may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GHW, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher: 6 credits

University Degree Requirements**First Year Engagement**

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

Integrated B.S. in Energy Engineering and M.S. in Energy and Mineral Engineering

Requirements for the Integrated B.S. in Energy Engineering and M.S. in Energy and Mineral Engineering can be found in the Graduate Bulletin (<https://bulletins.psu.edu/graduate/programs/majors/energy-mineral-engineering/#integratedundergradgradprogramstext>).

Program Educational Objectives

Our graduates will be:

1. Employed in the public or private sectors in the areas of energy science, energy engineering or energy business management, or pursuing an advanced degree.
2. Contributing to development of solutions to society's current energy needs by integrating key science and engineering principles while being adaptable to changing organizational and societal needs;
3. Engaged in individual projects and multidisciplinary teams designing, evaluating, and recommending methods and strategies for the efficient production, processing and utilization of renewable or non-renewable energy and addressing the associated environmental challenges;
4. Effectively communicating with management, coworkers, customers, clients and others in diverse environments;
5. Engaged in lifelong learning process to maintain professional competency through training, participation in professional activities and leadership.

Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Energy Engineering program is designed to enable students to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering science, and mathematics
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. Communicate effectively with a range of audiences
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/>)

University Park

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2023-24 academic year. To access previous years' suggested academic plans, please visit the archive (<https://bulletins.psu.edu/undergraduate/archive/>) to view the appropriate Undergraduate Bulletin edition (*Note: the archive only contains suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

Energy Engineering, B.S. at University Park Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year		
Fall	Credits Spring	Credits
MATH 140 or 140G (GQ) ^{*†##}	4 MATH 141 (GQ) ^{*†##}	4
CHEM 110 (GN) ^{**†}	3 ENGL 15, 30H, or ESL 15 (GWS) ^{††}	3
CHEM 111 (GN) ^{**†}	1 CHEM 112 (GN) ^{**†}	3
EMSC 100S (or CAS 100 by substitution) (GWS) ^{††1}	3 PHYS 211 (GN) ^{**†}	4
ECON 102, EBF 200, or ECON 14 (GS) [†]	3 General Education Knowledge Domain	3
	14	17
Second Year		
Fall	Credits Spring	Credits
PHYS 212 (GN) ^{**}	4 EE 211	3
CHEM 202 or 210	3 MATH 231 ^{**}	2
MATH 251	4 CMPSC 200 or 201	3
General Education Knowledge Domain	3 General Education Knowledge Domain	3
General Education Knowledge Domain	3 PHIL 103 (GH) [†]	3

	General Education Health and Wellness (GHW)	1.5
	17	15.5
Third Year		
Fall	Credits Spring	Credits
EGEE 12	1 EGEE 304*	3
MATSE 201	3 EGEE 437*	3
EME 301*	3 EGEE 430*	3
EME 303*	3 EGEE 451*	3
EGEE 302*	3 FSC 431	3
ENGL 202C (GWS) ^{††}	3 General Education Health and Wellness (GHW)	1.5
	16	16.5
Fourth Year		
Fall	Credits Spring	Credits
Professional Elective from Approved Department List ²	3 EGEE 464W*	3
FSC 432	3 EGEE 494, 295, 395, or 495*	2
EGEE 441*	3 EGEE Elective from Approved Department List ²	3
EME 460 or IE 302	3 Technical Elective from Approved Department List ^{2,3}	3
EGEE 411W*	3 Professional Elective from Approved Department List ²	3
Technical Elective from Approved Department List ^{2,3}	3 EGEE 438*	3
	18	17

Total Credits 131

* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

¹ Students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100, CAS 100A, CAS 100B, or CAS 100C (GWS) for EMSC 100S (GWS). EMSC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.

² Course lists for Energy Engineering can be found at the department website: <https://www.eme.psu.edu/undergraduate/academics/undergraduate-programs/energy-engineering-major> (<https://www.eme.psu.edu/undergraduate/academics/undergraduate-programs/energy-engineering-major/>).

³ Students may apply 6 credits of ROTC to some of the elective choices.

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

All incoming Schreyer Honors College first-year students at University Park will take ENGL 137H/CAS 137H in the fall semester and ENGL 138T/CAS 138T in the spring semester. These courses carry the GWS designation and replace both ENGL 30H and CAS 100. Each course is 3 credits.

Advising Notes:

To enter the major, students need a minimum 2.00 grade point average, third semester standing, and a C or better grade in CHEM 110 GN (3), CHEM 111 GN (1), CHEM 112 GN (3), MATH 140 GQ (4), MATH 141 GQ (4), MATH 231 (2), PHYS 211 GN (4), and PHYS 212 GN (4).

Courses required for the major may be offered fall semester only, spring semester only, or both fall and spring semesters. Consult with your adviser and department to discuss your academic progress and course sequencing.

Energy Engineering, B.S. at Commonwealth Campuses

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits Spring	Credits
MATH 140 (GQ) ^{*†#†}	4 MATH 141 (GQ) ^{*†#†}	4
CHEM 110 (GN) ^{*#†}	3 ECON 102, EBF 200, or ECON 14 (GS) [†]	3
CHEM 111 (GN) ^{*#†}	1 CHEM 112 (GN) ^{*#†}	3
ENGL 15, 30H, or ESL 15 (GWS) ^{††}	3 PHYS 211 (GN) ^{*#†}	4
General Education Knowledge Domain	3 General Education Knowledge Domain	3
	14	17

Second Year

Fall	Credits Spring	Credits
PHYS 212 (GN) ^{*#}	4 ENGL 202C (GWS) ^{††}	3
CHEM 202 or 210	3 MATH 231 ^{*#}	2
MATH 251	4 CMPSC 200 or 201	3
CAS 100, CAS 100A, CAS 100B, or CAS 100C (GWS) ^{††1}	3 General Education Knowledge Domain	3
General Education Knowledge Domain	3 PHIL 103 (GH) [†]	3
	General Education Health and Wellness (GHW)	1.5
	17	15.5

Third Year

Fall	Credits Spring	Credits
EGEE 12	1 EGEE 304 [*]	3
MATSE 201	3 EGEE 437 [*]	3
EME 301 [*]	3 EGEE 430 [*]	3
EME 303 [*]	3 EGEE 451 [*]	3
EGEE 302 [*]	3 FSC 431	3
EE 211	3 General Education Health and Wellness (GHW)	1.5
	16	16.5

Fourth Year

Fall	Credits Spring	Credits
Professional Elective from Approved Department List ²	3 EGEE 438 [*]	3
FSC 432	3 EGEE 464W [*]	3
EGEE 441 [*]	3 EGEE 494, 295, 395, or 495 [*]	2
EME 460 or IE 302	3 EGEE Elective from Approved Department List ²	3
EGEE 411W [*]	3 Technical Elective from Approved Department List ^{2,3}	3

Technical Elective from Approved Department List ^{2,3}	3 Professional Elective from Approved Department List ²	3
	18	17

Total Credits 131

- * Course requires a grade of C or better for the major
- ‡ Course requires a grade of C or better for General Education
- # Course is an Entrance to Major requirement
- † Course satisfies General Education and degree requirement

¹ Students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100, CAS 100A, CAS 100B, or CAS 100C (GWS) for EMSC 100S (GWS). EMSC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.

² Course lists for Energy Engineering can be found at the department website: <https://www.eme.psu.edu/undergraduate/academics/undergraduate-programs/energy-engineering-major> (<https://www.eme.psu.edu/undergraduate/academics/undergraduate-programs/energy-engineering-major/>).

³ Students may apply 6 credits of ROTC to some of the elective choices.

University Requirements and General Education Notes:

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W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

Advising Notes:

To enter the major, students need a minimum 2.00 grade point average, third semester standing, and a C or better grade in CHEM 110 GN (3), CHEM 111 GN (1), CHEM 112 GN (3), MATH 140 GQ (4), MATH 141 GQ (4), MATH 231 (2), PHYS 211 GN (4), and PHYS 212 GN (4).

Courses required for the major may be offered fall semester only, spring semester only, or both fall and spring semesters. Consult with your adviser and department to discuss your academic progress and course sequencing.

Career Paths

Careers

Our graduates are prepared to become valuable contributors in addressing society's energy needs and demands.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE ENERGY ENGINEERING PROGRAM (<https://www.eme.psu.edu/undergraduate/academics/undergraduate-programs/energy-engineering-major/>)

Opportunities for Graduate Studies

Graduates may be well suited to pursue graduate-level studies. Further study toward an M.S. or Ph.D. can lead to research, university, or management positions.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<https://www.eme.psu.edu/graduate/>)

Professional Resources

- Society of Energy Engineers Penn State Student Chapter (<https://www.eme.psu.edu/undergraduate/undergraduate-resources/student-organizations/>)
- National Electrical Contractors Association Penn State Student Chapter (<https://neca-pdj.org/students/penn-state-student-chapter/>)
- Engineers Without Borders (<https://sites.psu.edu/psuewb/>)

Accreditation

The Bachelor of Science in Energy Engineering at University Park is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the General Criteria.

Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

Contact

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